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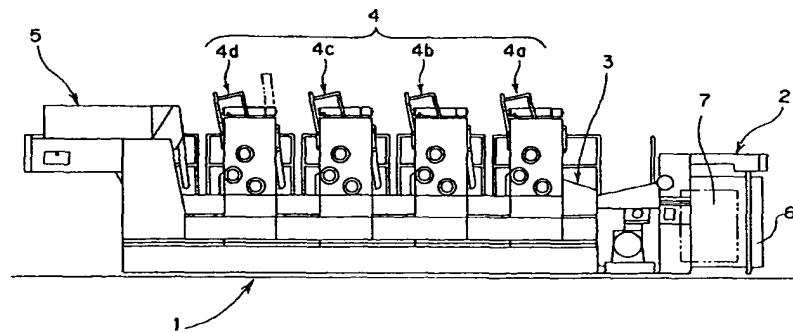
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### (54) Method of and apparatus for detecting abnormal paper feeding

(57) A method of and an apparatus for detecting an abnormal paper feeding which can reduce a working load for an operator and prevent a productivity and a printing quality from lowering by increasing a detecting function with respect to a timing shift of a fed paper so as to previously avoid various kinds of troubles caused by an abnormal paper feeding are provided. A control apparatus mentioned above is provided with number of fed paper memory means to which an ON signal from a product switch 10 as a paper feeding start signal generator, a reference pulse of a rotary encoder as a paper feeding signal generator for generating a signal in response to the paper feeding of the four color printing sheet paper rotary printer 1 and a paper existence signal and the like from a cylinder engagement sensor 11 as a paper existence detector are input, and which stores a

number of fed paper of the four color printing sheet paper rotary printer 1 from the beginning of the paper feeding till the first sheet paper 6 comes to the cylinder engagement sensor 11, and is structured such as to light on a pilot lamp 12 and output a paper feeding stop signal so as to turn off a product switch 10 by judging as an abnormal paper feeding in the case that the cylinder engagement sensor 11 does not output the paper existence signal when the number of the fed papers from the beginning of the paper feeding becomes equal to the number of the fed papers stored in the number of fed paper memory means, or in the case that the cylinder engagement sensor 11 outputs the paper existence signal when the number of the fed paper from the beginning of the paper feeding is less than the number of the fed paper stored in the number of fed paper memory means.

Fig.1



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**D**escription

## BACKGROUND OF THE INVENTION

## FIELD OF THE INVENTION

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[0001] The present invention relates to a method of and an apparatus for detecting an abnormal paper feeding as a safety apparatus for detecting an abnormal paper feeding from a paper feeding portion to a printing unit portion in a sheet printer.

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## DESCRIPTION OF THE PRIOR ART

[0002] In the case of performing a printing operation, an operator operates an apparatus so as to feed printing papers piled on a paper feeding portion to a printing unit portion, so that a printing operation is started. However, there is a case that a paper feeding is not normally performed due to "a poor setting in various kinds of apparatuses of the paper feeding portion" or "a trouble in the papers" or the like. In response to the abnormal paper feeding, various kinds of safety apparatuses are provided in each portion of a register or the paper feeding portion so as to automatically detect the abnormal paper feeding.

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[0003] For example, as disclosed in Japanese Utility Model Publication No. 2-39808, there has been an apparatus for detecting an abnormal paper feeding having a luminescent element and a photoreceptor element provided near a front lay in a feeder board of the sheet printer and detecting whether large or small the abnormal paper feeding state to the front lay of a sheet paper, and a control circuit which transmits a cylinder disengagement signal in synchronous with an operation of the printer and a control signal for discharging a sheet paper as a special state when the abnormal paper feeding state is large on the basis of a detected output from the photoreceptor element and transmits only the control signal in synchronous with an operation of the printer when the abnormal paper feeding state is small.

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[0004] In accordance with the apparatus, there is an advantage that as well as a number of suspension of operation can be reduced as much as possible, the sheet paper in a small abnormal paper feeding state can be discharged as the special state after being printed so as to be easily separate from a normal sheet paper.

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[0005] However, the conventional safety apparatus including the apparatus mentioned above performs a function as a safety apparatus by directly detecting "a positional shift of a paper" or "overlapping papers" or the like. Accordingly, there are following problems in a printing operation.

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(1) In the case that a paper does not reach a plurality of safety apparatuses provided in the register portion even when a timing for feeding a paper is shifted, an accurate detection and judgment relating to

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whether the paper feeding state is good or not can not performed.

(2) Generally, since the safety apparatus detects at a fixed timing (within a time period), there is a case that the detection of the abnormal paper is delayed when the timing of the fed paper is shifted, and the safety apparatus can not perform a function as a safety apparatus.

(3) There has been an example that the fed paper is interrupted by the register portion or a member provided on the feeder board, a lot of papers flow to the printing unit portion, and a damage trouble in the apparatus or a blanket or the like is caused.

(4) Since the trouble mentioned above is generated, it is necessary for the operator to always observe whether or not the paper fed from the paper feeding portion rightly enters to the register portion.

(5) When the trouble mentioned above is generated, not only the damage trouble is simply caused, but also a loss time for a post operation together therewith is generated, so that as well as a productivity and a printing quality are reduced, a working load for the operator is increased.

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## SUMMARY OF THE INVENTION

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[0006] Accordingly, an object of the present invention is to provide a method of and an apparatus for detecting an abnormal paper feeding which can reduce a working load for an operator and prevent a productivity and a printing quality from lowering by increasing a detecting function with respect to a timing shift of a fed paper so as to previously avoid various kinds of troubles caused by an abnormal paper feeding.

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[0007] In order to achieve the object mentioned above, in accordance with the present invention, there is provided a method of detecting an abnormal paper feeding comprising the steps of, detecting a number of fed papers for a printer by a paper feeding signal generator generating a signal in response to a paper feeding after starting the paper feeding, detecting whether or not a paper exists by a paper existence detector provided on a feeder board, and detecting an abnormal paper feeding in accordance with a relation between said number of the fed papers and said paper existence or non-existence.

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[0008] In the method of detecting an abnormal paper feeding according to the above, an abnormal paper feeding is judged in the case that said paper existence detector does not detect the paper existence when said number of the fed papers is equal to a preset fixed number.

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[0009] In the method of detecting an abnormal paper feeding according to the above, an abnormal paper feeding is judged in the case that said paper existence detector detects the paper existence when said number of the fed papers is less than a preset fixed number.

[0010] Further, in accordance with the present invention,

tion, there is provided an apparatus for detecting an abnormal paper feeding, which is used for the method of detecting an abnormal paper feeding according to the above comprising, a paper feeding start signal generator, a paper feeding signal generator generating a signal in response to a paper feeding of a printer, a paper existence detector provided on a feeder board, and a control apparatus having number of fed paper memory means for storing a number of fed papers for the printer till a first paper comes to the paper existence detector after the paper feeding is started, and detecting an abnormal paper feeding from a relation among the number of fed papers from said paper feeding signal generator, the number of the fed papers stored in said number of fed paper memory means and the detected signal of said paper existence detector so as to output a paper feeding stop signal.

[0011] In the apparatus for detecting an abnormal paper feeding according to the above, said control apparatus outputs the paper feeding stop signal by judging an abnormal paper feeding in the case that the paper existence detector does not detect the paper existence when the number of the fed paper for the printer after the paper feeding is started equals to the number of the fed paper stored in said number of fed paper memory means.

[0012] In the apparatus for detecting an abnormal paper feeding according to the above, said control apparatus outputs the paper feeding stop signal by judging an abnormal paper feeding in the case that the paper existence detector detects the paper existence when the number of the fed paper for the printer after the paper feeding is started is less than the number of the fed paper stored in said number of fed paper memory means.

[0013] In accordance with the method of and the apparatus for detecting an abnormal paper feeding mentioned above, an abnormal paper feeding due to a timing shift from the paper feeding portion to the register portion can be automatically and accurately detected, so that a paper feeding to the printing unit thereafter can be securely stopped.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### [0014]

Fig. 1 is a totally side elevational view of a four color printing sheet paper rotary printer which shows an embodiment in accordance with the present invention;

Fig. 2 is a detailed view of a main portion of a register portion which shows an embodiment in accordance with the present invention;

Fig. 3 is a plan view of an operation panel which shows an embodiment in accordance with the present invention;

Fig. 4 is a flow chart of an operation of a control apparatus which shows an embodiment in accord-

ance with the present invention; and Fig. 5 is a timing chart at a normal time and an abnormal time of the control apparatus which shows an embodiment in accordance with the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] A method of and an apparatus for detecting an abnormal paper feeding in accordance with the present invention will be described in detail on the basis of an embodiment with reference to the accompanying drawings.

[0016] Fig. 1 is a totally side elevational view of a four color printing sheet paper rotary printer which shows an embodiment in accordance with the present invention. Fig. 2 is a detailed view of a main portion of a register portion, Fig. 3 is a plan view of an operation panel, Fig. 4 is a flow chart of an operation of a control apparatus and Fig. 5 is a timing chart at a normal time and an abnormal time of the control apparatus.

[0017] As shown in Fig. 1, a four color printing sheet paper rotary printer 1 is structured such that a paper feeding portion 2, a register portion 3, a printing unit portion 4 and a paper discharging portion 5 are successively arranged in the order from the rightward, and a sheet paper 6 piled on the paper feeding portion 2 is discharged to the paper discharging portion 5 after being successively fed to a first to fourth color printing units 4a to 4d through the register portion 3 so as to be printed.

[0018] Then, a shift of a paper feed timing of the sheet paper 6 fed from the paper feeding portion 2 to the register portion 3 is automatically detected by a control apparatus (a control circuit) (not shown) within a control table 7 mounted on a side surface of the paper feeding portion 2, so that a paper feeding to the printing unit portion 4 thereafter is stopped.

[0019] Accordingly, the control apparatus mentioned above is provided with number of fed paper memory means to which an ON signal from a product switch 10 (mentioned below) as a paper feeding start signal generator, a reference pulse of a rotary encoder as a paper feeding signal generator for generating a signal in response to the paper feeding of the four color printing sheet paper rotary printer 1 and a paper existence signal and the like from a cylinder engagement sensor 11 (mentioned below) as a paper existence detector are input, and which stores a number of fed paper of the four color printing sheet paper rotary printer 1 from the beginning of the paper feeding till the first sheet paper 6 comes to the cylinder engagement sensor 11, and is structured such as to light on a pilot lamp 12 (mentioned below) and output a paper feeding stop signal so as to turn off a product switch 10 by judging as an abnormal paper feeding in the case that the cylinder engagement sensor 11 does not detect the paper existence when the number of the fed papers from the beginning of the pa-

per feeding becomes equal to the number of the fed papers stored in the number of fed paper memory means, or in the case that the cylinder engagement sensor 11 detects the paper existence when the number of the fed paper from the beginning of the paper feeding is less than the number of the fed paper stored in the number of fed paper memory means.

[0020] The product switch 10 mentioned above is disposed on an operation panel 13 provided in the paper discharging portion 5, as shown in Fig. 3, and outputs an ON signal (a signal for starting a paper feeding) by a pushing operation against a start button by the operator. Further, the pilot lamp 12 and a printer stopping button 14 are provided on the operation panel 13.

[0021] The cylinder engagement sensor 11 is fixed to a feeder board 15 provided in the register portion 3 by a fixing screw 16, as shown in Fig. 2, and is structured such as to detect whether or not the paper exists by a quantity of a reflected ray. Further, the cylinder engagement sensor 11 is threaded to a holder 17, and is structured such that a height of a detecting surface can be adjusted by a nut 18.

[0022] Further, the rotary encoder is provided on a rotary shaft in a drive system of the four color printing sheet paper rotary printer 1, and is structured such as to generate a signal of a pulse at every one rotation (at every one sheet paper 6).

[0023] Since the structure is made in the above manner, a printing operation can be begun by the operation that the operator performs a drive operation of the four color printing sheet paper rotary printer 1 (turns on the product switch 10). When the printing operation is started, the sheet papers 6 piled on the paper feeding portion 2 are automatically fed to the register portion 3 from the paper feeding portion 2, and are conveyed to the paper discharging portion 5 and piled there after being printed in each of the printing units 4a to 4d.

[0024] Normally, the printing operation is performed in the procedure mentioned above, however, there is a case that the feeding timing for the sheet paper 6 is shifted from the normal paper feeding timing at a time of starting the feeding of the paper sheet 6 due to various reasons.

[0025] In this case, in accordance with this embodiment, the control apparatus within the control table 7 mentioned above detects this, thereby turning on the pilot lamp 12 on the operation panel 13, outputting the paper feeding stop signal and turning off the product switch 10.

[0026] A control operation of the control apparatus will be described below on the basis of the operation flow chart shown in Fig. 4 with reference to the timing chart in Fig. 5.

[0027] At first, when the product switch 10 is turned on by the operator in a step P1, whether or not the sheet paper 6 exists is detected by the cylinder engagement sensor 11 in a step P2, and when the sheet paper 6 printed at the preceding time is left on the feeder board 15,

the product switch 10 is turned off in a step P16. That is, the control is performed until the remaining paper is removed.

[0028] When the remaining paper does not exist on the feeder board 15 in the step P2, the controls such as "an operation of turning on a feeder", "an operation of turning of a feeder pump", "an operation of opening a feeder valve" and the like are continuously and automatically performed in steps P3 to P5.

[0029] Next, after a paper feeding in the feeder is started in a step P6 and a counter is reset to zero in a step P7, whether or not the sheet paper 6 exists is again detected by the cylinder engagement sensor 11 in a step P8, and when the sheet paper 6 printed in the preceding time is left on the feeder board 15, the pilot lamp 12 is turned on in a step P17, the feeder is stopped (turned off) in a step P18 and successively the product switch 10 is turned off in the step P16.

[0030] When the remaining paper does not exist on the feeder board 15 in the step P8, a reference pulse of the rotary encoder is input in a step P9 and the counter starts a counting operation of the reference pulse in a step P10. That is, the number of the fed paper for the four color printing sheet paper rotary printer 1 till the first sheet paper 6 comes to the cylinder engagement sensor 11 from the beginning of the paper feeding is calculated by the reference pulse of the rotary encoder mentioned above.

[0031] Next, an actual number of the fed paper is compared with the fixed number of the fed paper (for example seven) previously stored in the number of fed paper memory means in a step P11, as a result in the case that the cylinder engagement sensor 11 detects the paper existence when the number of the fed paper is less than the number of the fed paper stored in the number of fed paper memory means, an abnormal paper feeding caused in accordance that the paper feeding timing is shifted to an early side is judged in a step P19, so that the pilot lamp 12 is turned on in a step P17, the feeder is stopped (turned off) in a step P18, and the product switch 10 is successively turned off in the step P16.

[0032] In the case that the cylinder engagement sensor 11 does not detect the paper existence in the step P19, a normal paper feeding is performed, so that the step is returned to the step P9 and a counting is continued.

[0033] Next, in the case that the cylinder engagement sensor 11 does not detect the paper existence when the actual number of the fed paper and the fixed number of the fed paper previously stored in the number of fed paper memory means are equal to each other in the step P11, an abnormal paper feeding caused in accordance that the paper feeding timing is shifted to a delay side is judged in a step P12, so that the pilot lamp 12 is turned on in the step P17, the feeder is stopped (turned off) in the step P18, and the product switch 10 is successively turned off in the step P16.

[0034] Practically, as shown in Fig. 5B, since the pa-

per existence signal from the cylinder engagement sensor 11 is not output in a detecting gate pulse at seven pulse to be output, a feeder stop signal is output. In this case, the detecting gate pulse is output during a fixed rotary angle of the printer with reference to the reference pulse (the timing pulse) from the rotary encoder.

[0035] In the case that the cylinder engagement sensor 11 detects the paper existence in the step P12, a normal paper feeding is performed, so that a cylinder engagement signal of the printing unit 4a for a first color is output in a step P13.

[0036] Thereafter, a printing operation in each of the printing units 4b to 4d for a second color to a fourth color is continued in a step P14, and a printing is completed in a step P15.

[0037] In this case, the pilot lamp 12 lighted on in the step P17 is automatically turned off when "the feeder is again turned on" after treating the sheet paper 6 abnormally fed.

[0038] As mentioned above, in accordance with the present invention, a post treatment caused together with the timing shift of the paper feeding can be omitted. Accordingly, a conventional observing operation for preventing the trouble from generating can be omitted.

[0039] As a result, the working load of the operator can be reduced and the loss time can be reduced, so that a productivity can be improved and a printing quality can be stabilized. Further, since the conventional cylinder engagement sensor 11 and rotary encoder can be used, it is advantageous in cost.

[0040] In this case, in the embodiment mentioned above, the reference pulse of the rotary encoder is used as means for detecting the number of the sheet papers 6 fed to the register portion 3 from the paper feeding portion 2, however, the structure may be made such that a sensor is provided in a part of a sucker main body and a number of the papers is counted at a position at which the sheet paper 6 is sucked by a first suction port so as to be lifted up, or that a sensor for detecting a pressure change is provided within a passage of a pipe of a sucker valve and a number of the papers is counted by detecting the pressure change in a state that the sheet paper is sucked.

[0041] Further, the present invention is not limited to the embodiment mentioned above, and it is needless to say that various kinds of modifications can be performed within a scope of the invention.

[0042] As mentioned above, in accordance with the method of and apparatus for detecting an abnormal paper feeding of the present invention, the control apparatus is provided with the number of fed paper memory means to which the signal from the paper feeding start signal generator, the signal from the paper feeding signal generator for generating a signal in response to the paper feeding of the printer and the paper existence signal from the paper existence detector on the feeder board are input, and which stores the number of the fed paper of the printer from the beginning of the paper feed-

ing till the first sheet paper comes to the sheet existence detector, and is structured such as to output the paper feeding stop signal by judging as an abnormal paper feeding in the case that the paper existence detector does not detect the paper existence when the number of the fed papers from the beginning of the paper feeding becomes equal to the number of the fed papers stored in the number of fed paper memory means, or in the case that the paper existence detector outputs the paper existence signal when the number of the fed paper from the beginning of the paper feeding is less than the number of the fed paper stored in the number of fed paper memory means. Accordingly, the abnormal paper feeding caused by the timing shift from the paper feeding portion to the register portion can be automatically and accurately detected, the paper feeding to the printing unit portion thereafter can be securely stopped, various kinds of troubles caused together with the abnormal paper feeding can be previously avoided so as to reduce the working load for the operator, and the productivity and the printing quality can be prevented from being lowered.

## 25 Claims

1. A method of detecting an abnormal paper feeding, the improvement is characterized by the steps of:
  - 30 detecting a number of fed papers for a printer
    - (1) by a paper feeding signal generator generating a signal in response to a paper feeding after starting the paper feeding;
    - 35 detecting whether or not a paper exists by a paper existence detector (11) provided on a feeder board (15); and
    - detecting an abnormal paper feeding in accordance with a relation between said number of the fed papers and said paper existence or non-existence.
  - 40
2. A method of detecting an abnormal paper feeding as claimed in claim 1, characterized in that an abnormal paper feeding is judged in the case that said paper existence detector (11) does not detect the paper existence when said number of the fed papers is equal to a preset fixed number.
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3. A method of detecting an abnormal paper feeding as claimed in claim 1, characterized in that an abnormal paper feeding is judged in the case that said paper existence detector (11) detects the paper existence when said number of the fed papers is less than a preset fixed number.
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4. An apparatus for detecting an abnormal paper feeding, which is used for the method of detecting an abnormal paper feeding as claimed in claim 1, the

improvement comprising:

a paper feeding start signal generator (10);  
a paper feeding signal generator generating a  
signal in response to a paper feeding of a print- 5  
er (1);  
a paper existence detector (11) provided on a  
feeder board (15); and  
a control apparatus having number of fed paper  
memory means for storing a number of fed pa- 10  
pers for the printer (1) till a first paper comes to  
the paper existence detector (11) after the pa-  
per feeding is started, and detecting an abnor-  
mal paper feeding from a relation among the  
number of fed papers from said paper feeding 15  
signal generator, the number of the fed papers  
stored in said number of fed paper memory  
means and the detected signal of said paper  
existence detector (11) so as to output a paper  
feeding stop signal. 20

5. An apparatus for detecting an abnormal paper feed-  
ing as claimed in claim 4, characterized in that said  
control apparatus outputs the paper feeding stop  
signal by judging an abnormal paper feeding in the  
case that the paper existence detector (11) does not  
detect the paper existence when the number of the  
fed paper for the printer after the paper feeding is  
started equals to the number of the fed paper stored  
in said number of fed paper memory means. 25

6. An apparatus for detecting an abnormal paper feed-  
ing as claimed in claim 4, characterized in that said  
control apparatus outputs the paper feeding stop  
signal by judging an abnormal paper feeding in the  
case that the paper existence detector (11) detects  
the paper existence when the number of the fed pa- 30  
per for the printer after the paper feeding is started  
is less than the number of the fed paper stored  
in said number of fed paper memory means. 35

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Fig.1

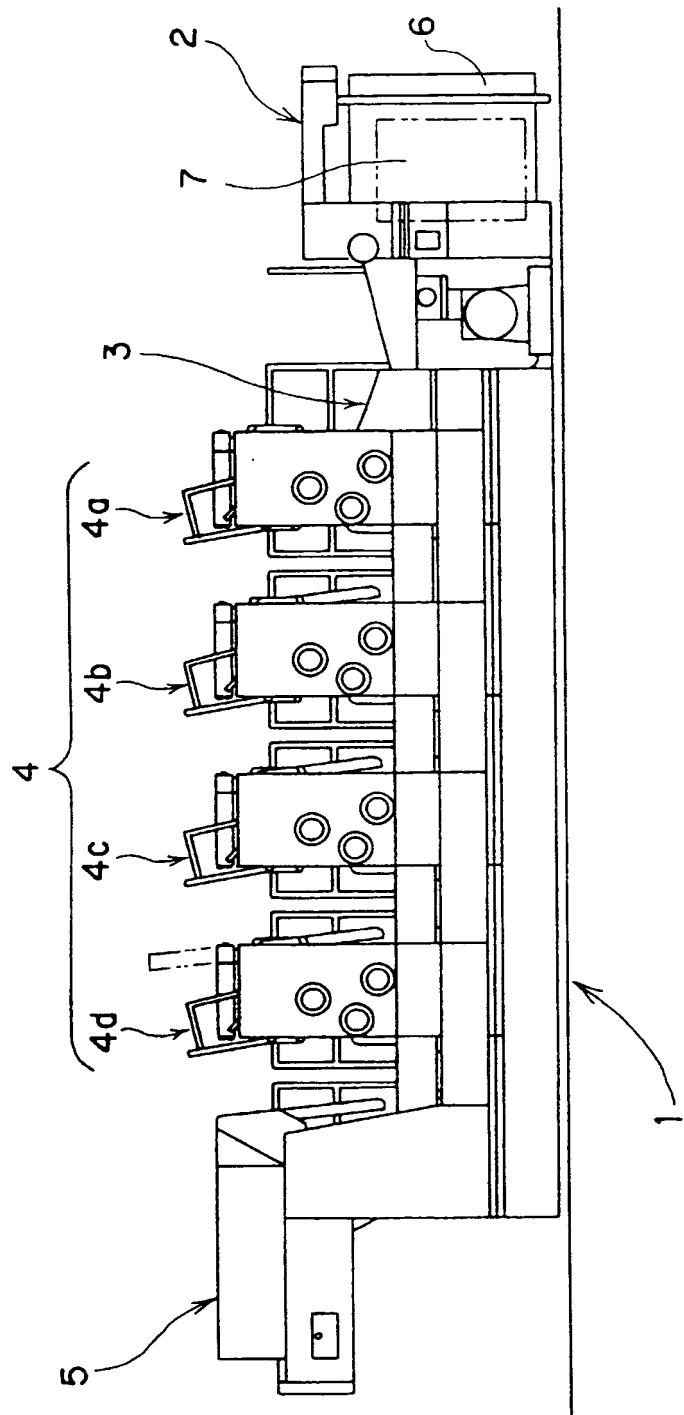


Fig.2

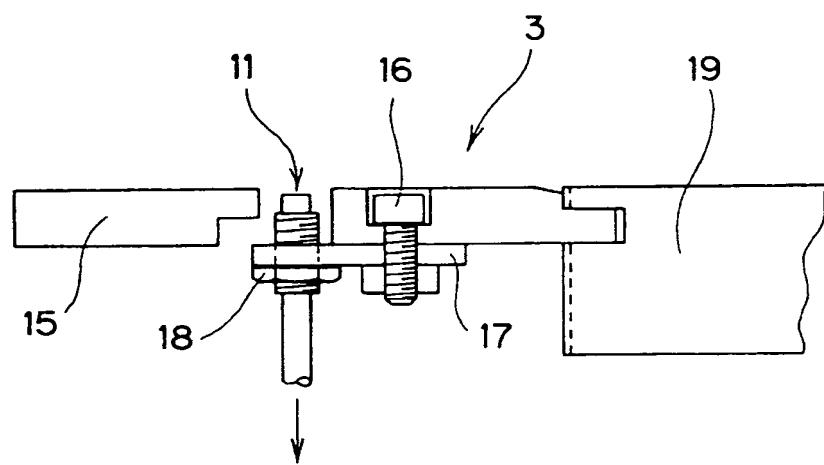


Fig.3

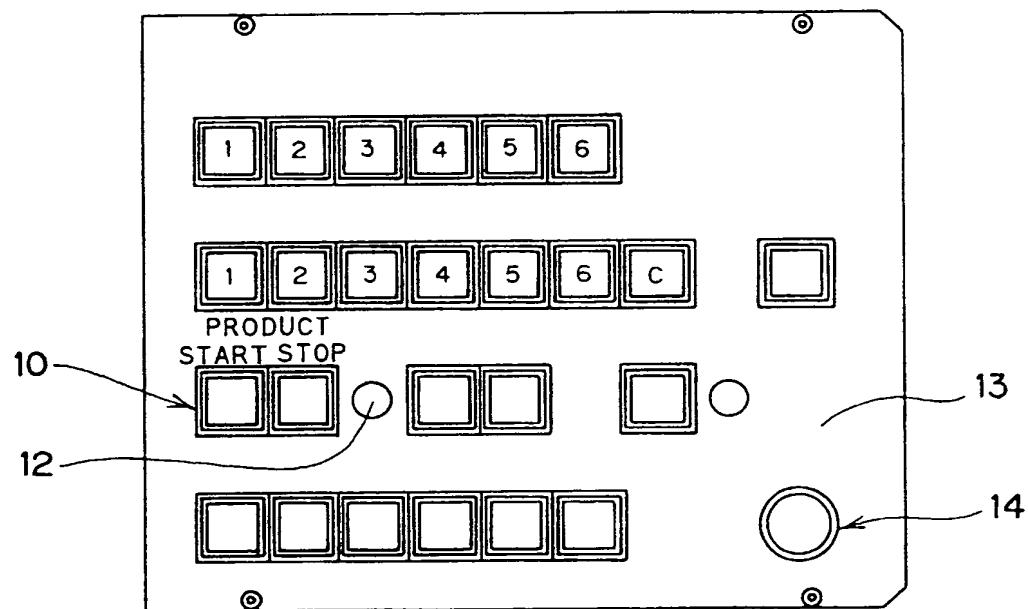
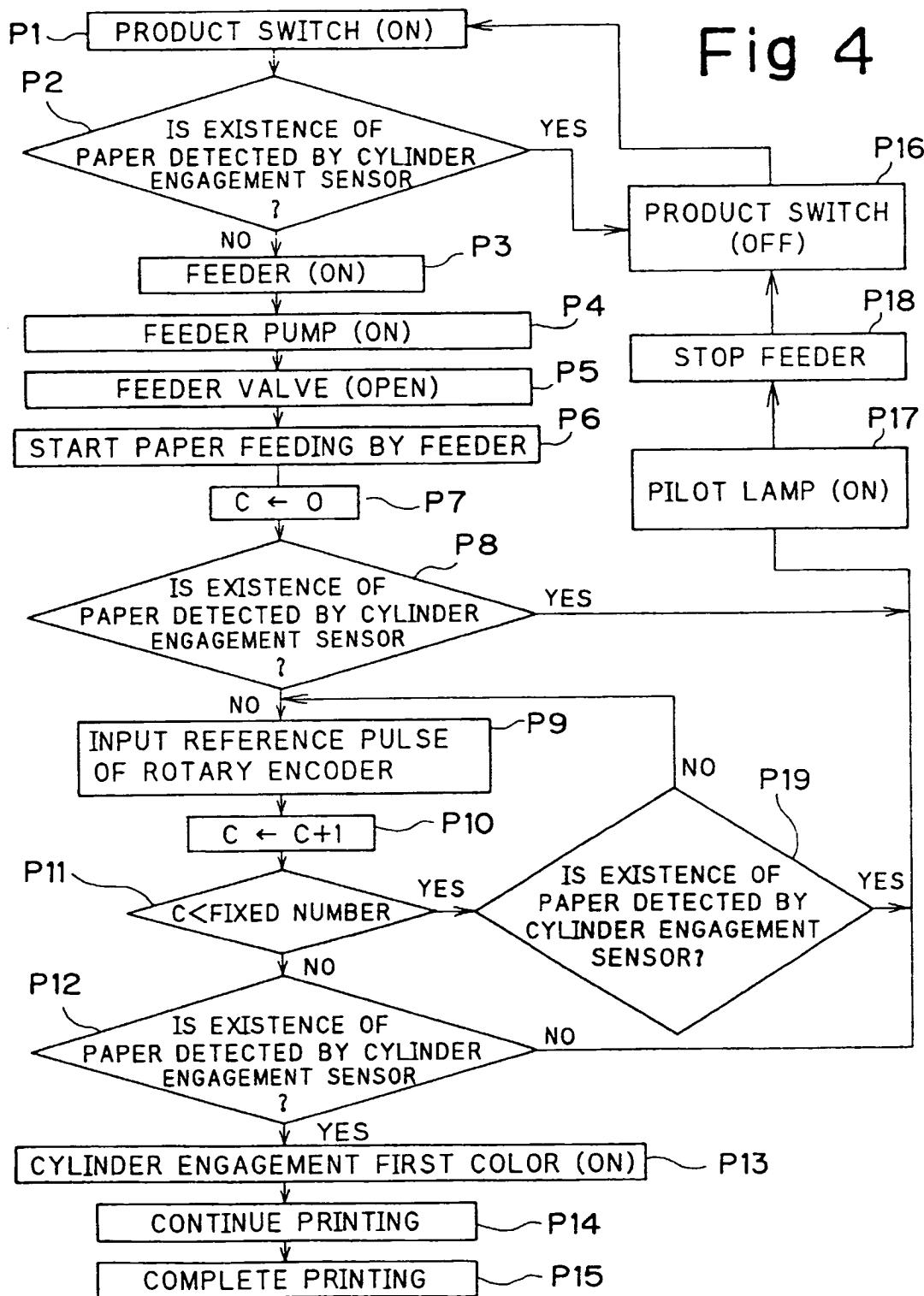
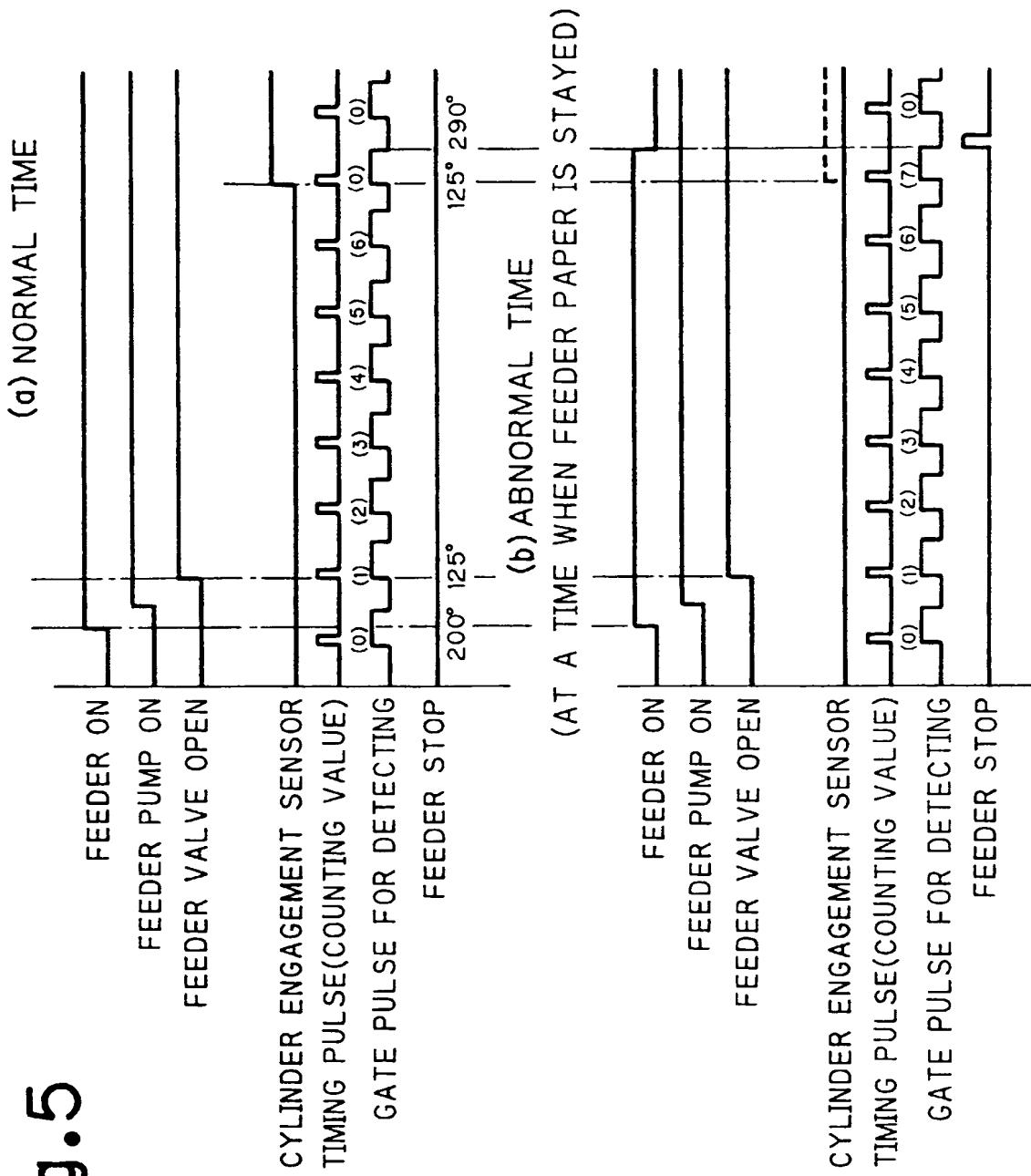


Fig 4



**Fig.5**



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## EUROPEAN SEARCH REPORT

Application Number  
EP 98 25 0394

DOCUMENTS CONSIDERED TO BE RELEVANT			
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<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	9 March 1999	Henningsen, O	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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09-03-1999

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